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ABSTRACT

Arguing that new technologies such as telefacsimile, electronic publishing, and electronic document delivery are altering the processes of communication and the response of libraries to scholars' needs, this paper provides a vision for the future, particularly with regard to the impact of electronic publishing on the traditional roles of academic and research libraries. Several aspects of electronic publishing are described and the characteristics of where, how, and why electronic publishing is emerging are explored from the perspective of political, social, technical, and economic issues. Several examples of electronic publishing proposals or projects are examined--e.g., online information retrieval database services, videotex, optical disks, direct broadcast satellites (DBS), electronic document delivery (EDD), electronic mail systems, and the electronic journal--and the impact of electronic publishing on libraries is discussed. An examination of the benefits that may be accrued from the changes taking place in the process of scholarly communication concludes the report. It is suggested that the three partners in the process of scholarly communication--the library, publishing, and the academic community--must realize the opportunities and responsibilities inherent in the emergence of this new technology. (12 references) (MAB)

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**Occasional Paper
1**

**Libraries and the Changing
Scholarly Process**

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PREFACE

The School of Library and Information Science at the University of Wisconsin-Milwaukee is initiate its new series of Occasional Papers for the purpose of disseminating information on important issues in the library and information professions. This first issue of the Occasional Papers Series features a presentation by Donald B. Simpson on a topic of great interest to scholars, librarians in particular and information professionals in general. The text is based on the Convocation address which Mr. Simpson delivered at the School of Library and Information Science Fall 1989 Convocation.

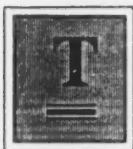
In his presentation Mr. Simpson discussed and analyzed the technologies that improve resource sharing and the provision of research materials to library users: microfiche, electronic publishing, and electronic document delivery. These technologies and the global view of library holdings that automate bibliographic databases have created are altering the processes of communication and the response of libraries to scholars' needs. These are areas with which Mr. Simpson is all too familiar due to his daily involvement with these and related issues in his capacity as the President of the Center for Research Libraries. Located in Chicago, Illinois, the Center for Research Libraries was founded in 1949 to maintain a collectively-owned library of research materials that are rarely-held among North American libraries and infrequently consulted at any one library. The Center, a research library of more than 4.5 million volumes, is cooperatively owned and operated by 133 university, college and research libraries throughout North America. In his current position as the chief executive of a cooperative research library and in his work with networks, resource sharing, and the automation of library services, Mr. Simpson has assumed a national role in the provision of bibliographic and textual information to the scholarly community.

Mr. Simpson's professional experience has been in libraries of increasingly broader scope and purpose. He began his career in a college library, where he automated portions of the acquisitions process. Then, as the Head of the Catalog Center at the State Library of Ohio, Mr. Simpson expanded the shared use of the newly emerging OCLC system to smaller libraries throughout Ohio. From 1975 to 1980, he was the first executive director of the Bibliographical Center for Research (BCR) in Denver, the regional library network that provides OCLC and other computerized bibliographic services to libraries in the thirteen intermountain states.

Mr. Simpson became the third director of the Center for Research Libraries in July 1980, and was elected its first president and chief executive officer in 1986.

LIBRARIES AND THE CHANGING SCHOLARLY PROCESS provides a vision for the future particularly with regard to the impact of electronic publishing on the traditional roles of academic and research libraries. We agree with Donald Simpson's call for greater attention to the scholar's needs in an electronic publishing environment and that the three partners in the process of SCHOLARLY communication—scholars, publishers, and librarians must come to realize the opportunities and responsibilities inherent in the emergence of new systems. These concerns are taken into account in the courses we teach at the School and the research component of our program.

Mohammed M. Aman, Dean
School of Library and Information Science
September 1989



he common focus existing between academic librarians and academicians is the library, an institution in which librarians practice the arts and sciences related to the organization, storage, and retrieval of knowledge. When the roles of the librarian - organization, storage, and retrieval of knowledge - are combined with the roles of the scholar - creation, communication, and application of knowledge - what results is a process or system of scholarly communication. The scholar, as the creator and user, is both the central figure and the reason why the system exists. While it is a serious omission to overlook other participants in the process, (e.g. the publishers), the librarian, by ensuring the availability of knowledge manifested in books, journals, manuscripts and other formats, has a pivotal function and is an important partner to the scholar.

The process of scholarly communication between scholars and librarians has remained essentially the same for many generations. Changes are underway, however, driven primarily by emerging technologies that are pursued largely as solutions to economic problems. Since the library is a fundamental element of the scholarly process, the changes affecting it are having an impact on scholarly communication. As academic librarians, it is vital that we make a sustained effort to understand not only the widespread changes within our libraries, but also the concomitant ramifications such changes have on scholarly communication. We must attempt to draw as many conclusions as possible as to what is happening in order to know the future roles librarians will play in scholarly communication.

A central term to this paper is "the scholarly process" or as more commonly stated today, "the process of scholarly communication." What "the process of scholarly communication" means and what it has to do with libraries is an important consideration for academic librarians.

A case in point: A young boy asks his mother how much she weighs. His mother responds by saying that there are some questions inappropriate to ask another person. Next, the boy asks his mother how old she is. Growing impatient, the mother replies that her age is none of his concern and that he shouldn't ask such questions. Oblivious to his mother's chiding, the little boy then asks the mother why she and his father were divorced. Now fully irritated with her son's questions, the mother says she will listen to no more questions of this sort and promptly leaves the room. The boy notices his mother's purse lying on the table and opens it finding her driver's license inside. He looks at the document with curiosity and then puts it back. A moment after he closes the purse his mother returns to the room. The little boy then says to his mother that he knows her weight to be 105 lbs. His mother looks at him with amazement while he goes on to tell her that she is 29 years old. Finally, the little boy looks his mother squarely in the eye and informs her that not only does he know her weight and her age, but he also knows the reason why she and his father had been divorced -- she had gotten an "F" in sex.

The point of this story is that we have to know what we mean when we use certain terms - like "sex" on a driver's license - in order to draw the right conclusion. Possessing an understanding of what is meant by the "process of scholarly communication" is no exception.

The 1979 report of the National Enquiry into Scholarly Communication offers a definition of what is commonly meant by "the process of scholarly communication."

"For as long as any of us can remember, the system of scholarly communication has worked in the following way: Scholars toiled in the library or in their studies or by doing research in the field; they wrote what they had to say; the writings were judged by their peers; some writings fell by the wayside or went back for revision, but the best were published in journals or books; the journals or books were collected and arranged in libraries where other scholars could use them. It was a cyclical flow that continually renewed itself and enriched human knowledge and understanding."¹

Scholars generally agree that our civilization began in the lush valleys of the Tigris and Euphrates Rivers in what is now the nation of Iraq. Man's environment fostered the development of agriculture, which allowed settling in one place as opposed to roaming in search of food. As the settlements grew larger, writing was invented as a way to deal with the practical affairs of daily life in a communal setting. It is from this humble start that the three closely related communities of the scholar, the publisher, and the librarian emerged. As time passed, the scholar began to reflect and project on all aspects of life and nature. The publisher took on the task of recording the thoughts of the scholar, and eventually of distributing the recorded thoughts to other scholars. The librarian's role in the evolving process of scholarly communication was to organize and preserve the recorded knowledge of scholars, and later to act as an intermediary between the collections of recorded knowledge and other scholars. The processes of the generation of knowledge and the path of scholarly communication are skillfully illustrated in King, McDonald, and Roderer's *Scientific Journals in the United States: Their Production, Use and Economics*.²

The two essential links among the three communities are the knowledge itself and, more importantly for the focus of this paper, the medium. The medium has changed, of course, with the passage of time. Even though writing was in use, early scholars were skeptical of the process to the extent that they often assumed simultaneously the roles of scholar, publisher and librarian. The librarian often did little to dispel the lack of trust as we see from my favorite passage in Umberto Eco's *The Name of the Rose*:

"You see, Brother William," the abbot said, "to achieve the immense and holy task that enriches those walls"--and he nodded toward the bulk of the Aedificium, which could be glimpsed from the cell's windows, towering above the abbatial church itself--"devout men have toiled for centuries, observing iron rules. The library was laid out on a plan which has remained obscure to all over the centuries, and which none of the monks is

called upon to know. Only the librarian has received the secret, from the librarian who preceded him, and he communicates it, while still alive, to the assistant librarian, so that death will not take him by surprise and rob the community of that knowledge. And the secret seals the lips of both men. Only the librarian has, in addition to that knowledge, the right to move through the labyrinth of the books, he alone knows where to find them and where to replace them, he alone is responsible for their safekeeping. The other monks work in the scriptorium and may know the list of the volumes that the library houses. But a list of titles often tells very little; only the librarian knows, from the collocation of the volume, from its secrets, what truths or falsehoods, the volume contains. Only he decides how, when, and whether to give it to the monk who requests it..."³

Eventually, paper became the media of choice for recording scholarly documents and scrolls became codices. Scholarly communication took a quantum leap in 1439 when Johan Gutenberg discovered a way to print from movable types cast from matrices, a process he described as "adventure and art." It is at this point that the roles of scholar, publisher, and librarian become discrete.

A singularly important medium for scholarship, the journal, began to appear in the mid seventeenth century. Among the first were those established by the Royal Society of England. Houghton⁴ traces the beginning of what he believes to be the first scientific journal, the *Journal des Scavans*, founded in 1665 by deSallo, a counsellor of the French court of the Parliament. According to Koch⁵, the characteristics of such journals were well developed when the scientific and technical communities in the United States began to establish their own journals in the nineteenth century. *Physical Review* and *Journal of the American Chemical Society* are used as primary means for scholarly communication in their fields.

Now in the late twentieth century comes the advent of electronic publishing, which I believe will generate significant changes in the three communities linked by the process of scholarly communication. As a matter of course, there is a debate on the type of change, the extent of change, and the speed of change. King⁶ argues that while the journal has not changed

much in 300 years, current events may bring about sweeping and immediate change. These current events indicate that: (1) increasing numbers of journal articles are being distributed as separate copies rather than whole issues; (2) library resource sharing networks are multiplying and improving; (3) electronic processing technology applicable to the process of scholarly communication is advancing rapidly. On the other hand, Koch⁷ believes that in physics electronic publishing has made little headway, but sees a slow drift toward electronic journals. This is caused by a dependence on the effective use of analog displays and the continued economic success of the print-on-paper format.

In what follows, I will define and describe electronic publishing in its many aspects. The characteristics of where, how, and why electronic publishing is emerging will be explored from the perspective of the political, social, technical, and economic issues involved are examined. Several examples of electronic publishing proposals or projects will be examined and the impact of electronic publishing on libraries will be discussed. Lastly, I will draw a conclusion concerning the benefits that may be accrued from the changes taking place in the process of scholarly communication.

What is electronic publishing? I define it as a series of techniques employing processes using electronic technologies as vehicles to transfer information from originator to assimilator. As a method to examine the distinctions among the electronic processes and technologies emerging in scholarly communication, it is useful to take a look at both Russon⁸ and Gurnsey⁹ who agree that there are two main types of electronic publishing. Russon describes them as "fully electronic publishing" where a unique electronic document is created which may never appear in print and "parallel publishing" where an electronic copy of a conventionally printed and published text is created. Gurnsey describes them as (1) the use of computers to facilitate the production of a conventional product and (2) the use of computers and telecommunications systems to distribute data electronically. Russon's categories seem to distinguish two types of products, while Gurnsey's focus is on two processes.

Russon states that either product is available in centralized distribution form (e.g., a journal online in a single, large data base system) or decentralized distribution form (e.g., a journal on optical disk played on local equipment). Russon offers Pergamon's Video Patsearch as an example of a hybrid system with both characteristics. The two categories of products and two of distribution patterns combine to form a two-dimensional matrix useful for describing existing and potential electronic publications. The parallel publishing, centralized distribution form can be seen in the abstracting and indexing services which publish both print and online products, but also mount their electronic version on large information retrieval systems. The parallel publishing, decentralized distribution form can be likened to a microform copy of a print-form publication.

The electronic publishing, centralized distribution form is still relatively rare, although there are several journals that are available only in machine-readable format. Other examples are viewdata and teletext systems. Information Access Corporation announced in 1984 its development of two full text online computer data bases containing 130 major magazine titles from 47 publishers available through Lockheed's Dialog. The electronic publishing, decentralized distribution form is not yet widely available, but might include a locally mounted electronic package (similar to Information Access Corporation's Magazine Index in full text form stored as images) of journals available only in electronic form.

In the first of Gurnsey's two divisions of electronic publishing (i.e., the use of computers to facilitate the production of a conventional product), publishers have high hopes for the profitability of turning to electronic processes for author input, editing, redaction, composition, and distribution. Computers, lasers, digitalization of text, and screen-based technologies are beginning to play a major role in the printing and publishing industries. Keyboarding seems likely to continue as the dominant input device although voice input may be widely used in the not-too-distant future if word recognition levels can be increased. The use of optical character recognition (OCR), if its cost and error detection problems continue to be resolved, may rise considerably. Computer photocomposition, particularly using electronic character generation, is gaining popularity in the publishing industry. Recent developments in ink jet printing have brought about a dramatic drop in prices for these devices. Other printing devices using laser imaging techniques and digitized information print either electrophotographically or electrostatically. Hardware forecasters predict that exceptionally high resolution of 4,000 dots per inch or more will soon be possible to store and retrieve quickly and cheaply using these devices.

Many different distribution processes manifest Gurnsey's second division of electronic publishing. Online information retrieval database services have become a major industry in the last twenty-five years with annual sales exceeding several billions of dollars. There are three sectors in this portion of the industry. The first sector, bibliographic data bases, accounts for roughly 10% of the total and OCLC is the largest vendor. The second, data banks, accounts for the bulk of the total market and consists of two major service areas: (1) collection, collation, and provision of access to specialized information files or data processing services; and (2) provision of access only. The third sector, full text services, is still in its infancy, but legal systems are the market leaders.

A second distribution process is videotex, the generic description for computer-based information services using a standard television set as the display device. Videotex can be transmitted either by broadcast, by cable, or over the telephone. Teletext and Viewdata, both initiated in the United Kingdom, France's Teletel, Canada's Telidon, and the United States' Ceefax are the preeminent examples of this device. In recent years, several gateway projects (i.e., a multiplexing system allowing access to a variety of linked databases) have gotten underway in West Germany and Canada. The largest library bibliographic system in the world, OCLC, is reconfiguring its basic structure into a gateway.

Optical disks are a third distribution process; they store images or data signals - either analog or digital - on a rotating disk. Problems related to multiple incompatible formats (there are three) and technologies (there are at least four) have slowed this format from becoming a major distribution device. The Library of Congress conducted experiments using optical disks to store its card reproduction masters while still providing that service. LC appears to have rejected this technology as a preservation tool in favor of mass deacidification. The shelved ADONIS project involved a number of European scientific, technical, and medical publishers distributing packages of full text journals captured on optical disks and linked to a microcomputer based retrieval system.

The direct broadcast satellites (DBS) are a fourth distribution means of interest to the scholarly communication process. With DBS, a signal is relayed to a satellite, which re-transmits it to individual ground stations. The major drawbacks have been the costs of launching a satellite and setting up a ground station. With much cheaper receiving dishes coming on the market, this technology may become a much more attractive distribution method.

Electronic document delivery (EDD), a fifth distribution process, is becoming a main focus for interlibrary cooperation, stimulated in part by the demand for full text documents which has been generated by the increasing use of the bibliographic citation and abstract database systems. At the same time, the increasing financial problems facing the library community coupled with steady growth in user demand and publishing output have conspired to place enormous pressures on libraries. The purpose of electronic document delivery is to provide full text documents on demand. The form of the document could be facsimile which involves storing, retrieving, and delivering the document in an exact copy of the original, or text, which at present means some degradation of layout, font type, and graphics for all but the most expensive of equipment. At each stage of the process, there are choices involving many of the technologies mentioned previously in this paper. The major problem facing EDD is the overriding need for these services to match or undercut the costs of conventional delivery methods. This problem is exacerbated by the severe cost differential between loading and storing documents whose text originates in machine readable form versus those whose text must be converted by a scanning process that converts from analog to digital. A further difficulty is that the technology presently available does not offer at a reasonable cost the high resolution necessary for graphics. Access mechanisms and copyright questions also are of significant magnitude in electronic document delivery.

Electronic mail systems comprise a sixth distribution method. While a number of electronic mail systems have sprung into use, only recently have these been employed in electronic publishing as a means for author input, in formal scholarly communication, and request transmission. None appear to be used for distribution of "published" text. Such systems are usually formatted for short documents and none as yet support elaborate graphics.

Lastly, a seventh major electronic publishing distribution process is the electronic journal. The premise of the electronic journal is that the creation, editing, refereeing, and distribution of a scholarly work are accomplished without any intermediaries. Gurnsey suggests that the impetus for the electronic journal derives from the opinion among scholars that conventional publishing fails to meet the speed of dissemination that some disciplines require. Major questions that may hamper the emergence of this method focus on utility of increased speed of publication, at presumed greater cost, for non-scientific disciplines, the lack of clarity in the perceptions of users' attitudes, and the need for new bibliographic control codes. From the library's point of view, the questions of retrospective availability and archiving are very serious indeed. Can librar-

ies afford, through their cooperatives, to maintain low transaction volume but high unit cost services for the lesser used journals, while the commercial sector provides the profitable high volume-low unit cost services?

Why is electronic publishing emerging? Aside from the various needs, concerns and interests highlighted earlier, the reasons for scholars are mainly a need for improved service, for publishers largely a concern for the escalating costs facing the publishing industry, and for librarians mostly an interest in enhancing the availability of scholarly materials. Some of the factors bearing on the situation are the decreasing cost of computer memory, the changing complexities of telecommunications, the rising costs of labor, the increasing volume of published materials, and the expanding costs of marketing and distribution processes.

While each of the electronic publishing products and processes attracts its share of advocates -- both positive and negative -- there is one that seems to dominate the interest of the interrelated communities of scholars, publishers and librarians: the electronic journal. Hickey¹⁰ concludes that the journal can be expected to undergo radical change over the next decade as online access becomes a reality. The basic unit of publication will be the article rather than the journal, and articles will be printed upon demand by computer terminals. Seiler and Raben¹¹ trace a brief history of publishing and envision a futuristic publishing environment based on technological capabilities that exist or are being developed. They use this as a backdrop for a study of academic and administrative attitudes toward the electronic dissemination of research as compared with conventional means. Seiler and Raben conclude that apparently no prejudices exist in the academic setting toward equal rewards for electronic publication as print-on-page publication. For the reasons cited earlier, Koch predicts that the shift to electronic publishing for physics journals will be slow paced.

King, on the other hand, offers a sense of excitement that advancements in office word processing, telecommunications, technology for non-scientific publication, online bibliographic searching, super microcomputers, and mass digital storage will offer significant benefits to scholarly communication. At the end of his book, King offers a prescription for a flexible, economic, integrated electronic journal system from author preparation using sophisticated text-editing systems to online editing to reviewing by computer conferencing to automated redaction to mass memory storage until demanded. The entire process is a machine-based integration of author, editor, publisher, reviewer, redactor, abstractor/indexer, requestor, deliverer, librarian/archivist, and reader. However, King sees some powerful constraints on the proposed system. The first is a lack of economic incentive to change -- a similar constraint seen by Koch. Next, King suggests there is a lack of technical incentive to change by the system's users. Libraries, too, have little motivation to shift from traditional patterns. There are technological barriers in that few standards have been established, graphics cannot be easily and cheaply handled, telecommunications costs, which must fall, may be rising instead, and data input of current and retrospective literature remains unrealized.

Lerner and Mick's¹² project for the American Institute of Physics (funded by the National Science Foundation) tested non-traditional formats for publishing and distributing research information. They found the technologies employed to be viable in that the quality of products was generally acceptable and the speed of delivery was excellent. After studying the human factors in accepting a new information service, they concluded that the study opened as many questions about the electronic journal as it answered, that the electronic journal may be somewhere down the road in the future, and that information services generally suffer from a poor image.

In response to the lack of standards in many aspects of electronic publishing, the Association of American Publishers instituted an AAP Electronic Manuscript Project. The objective is to establish standard and companion guidelines for the processing of manuscripts. A special challenge is to produce it in a practical and usable form which can be widely adopted in a natural and evolutionary fashion.

Russon lists ten areas in library operations that will be impacted by a shift toward electronic publishing. Appropriate equipment will be required to retrieve, view, and print documents stored in electronic form. Additional equipment will change the equipment costs budget owing to purchase and maintenance costs. Staff will require training in special skills to use the new equipment and systems. Electronic publications will require librarians to give serious consideration to the library's pricing policies in that direct and obvious costs tend to be higher than in conventional publications. The major impact on libraries and their users is the increase in access to the information users seek. How will electronic publishing impact the preservation of library materials? Space saving will be an impact in that electronic storage is very compact and may alter the need for additional library buildings. A major issue to be addressed by the scholarly community is the impact of electronic publishing on the archival function of research libraries. A system of bibliographic control must be developed to take full advantage of the new media. Copyright royalties and control are major questions that impact libraries using electronic publishing products and processes.

I will add two other impacts that Russon omitted: (1) the impact on collection and (2) the impact on library relationships. Electronic publishing may tend to focus prospective collecting on materials that are demanded rather than collected using a rational collecting plan. Since prospective acquisitions are the stuff out of which retrospective collections are made, the question has serious implications. Will libraries merely become archival institutions trading materials among each other in order to arrive at a rational cohesive local collection, not unlike young children trading baseball cards? This may be the most important impact of all, and when combined with archives, bibliographic control, and copyright, it presents a formidable array of issues to be addressed.

Will a library's fundamental relationships change in an electronic environment? If electronic publishing replaces conventional publishing, it seems conceivable that a library's relationship to the scholar may change. Scholars may turn to libraries for archived

materials and place their demands for current materials directly with electronic vendors; on the other hand, sophisticated electronic systems may require a skilled professional intermediary to assist the scholar, particularly outside his or her primary field. Will publishers and librarians become competitive adversaries rather than complementary partners in scholarly communication? How will a library's resource sharing relationships be affected by electronic publishing? Obviously, this is an area that requires substantial study and reflection.

Electronic publishing, similar to Toffler's third wave, will be implemented over a long period of time. It seems unlikely that it will replace completely conventional publishing in all disciplines for a very long time. Because electronic publishing is at a very early stage of development, numerous changes and important opportunities for refinements are present.

Greater attention must be paid to the scholar's needs in an electronic publishing environment. From what has been offered and tested so far, the products and services likely to succeed must: (1) be generated easily and cost-effectively from existing systems; (2) be distributed through a variety of means; (3) require small capital investment by scholars and users; (4) demonstrate advantages over the conventional system; and (5) require little user training.

Most important of all, the three partners in the process of scholarly communication - scholars, publishers, and librarians - must come to realize the opportunities and responsibilities inherent in the emergence of new systems. As yet, no effective leadership for coordination has produced an active pursuit of cooperation among the sectors. Without that cooperation, all sectors will lose some of the benefits that can be obtained from electronic publishing. Since the librarians are traditionally the intermediaries, it seems appropriate to suggest that this sector provide the coordinative leadership. This, then, is the important role of librarians in the changing scholarly process.

ENDNOTES

¹The Board of Governors of the National Enquiry, *Scholarly Communication: The Report of the National Enquiry* (Baltimore, Johns Hopkins University Press, 1979), p. 30.

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¹²Lerner, R.G. and Mick, C.K., "Database Searching and Document Delivery Via Communications Satellite," a final report to the National Science Foundation, (American Institute of Physics, 1980).

